

NON-PUBLIC?: N  
ACCESSION #: 9502150280  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: BYRON NUCLEAR POWER STATION, UNIT 2 PAGE: 1 OF 4

DOCKET NUMBER: 05000455

TITLE: REACTOR TRIP/TURBINE TRIP DUE TO SOLID STATE PROTECTION  
SYSTEM UNIVERSAL LOGIC CARD INTERMITTENT FAILURE  
EVENT DATE: 11/23/93 LER #: 93-008-01 REPORT DATE: 02/08/95

OTHER FACILITIES INVOLVED: NONE DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:  
NAME: RICK HILDEBRAND, SYSTEM ENGINEER TELEPHONE: (815) 234-5441  
EXT. 2472

COMPONENT FAILURE DESCRIPTION:  
CAUSE: X SYSTEM: JB COMPONENT: W120 MANUFACTURER:  
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

#### ABSTRACT:

On November 23, 1993, at 0040, with Unit 2 at 100% power and Normal Operating Pressure and Temperature, the Instrument Maintenance Department (IMD) was performing surveillance 2BIS 3.1.1-024 which tested loop LB559C, 2D Steam Generator (SG) level (FW) JB!. The loop was put in test as required and the appropriate alarms came up. Anticipated Transient Without Scram Mitigation System (AMS) was also put in test per the surveillance and the associated alarms came in. Six minutes into the loop functional check, the 2A Auxiliary Feedwater (AF) BA! pump auto started and all steam generator blowdown isolation valves closed concurrently. Approximately 3 minutes later a reactor trip occurred with reactor trip breaker A opening. All related plant parameters were normal prior to the event. All operations and Instrument Maintenance personnel actions were appropriate prior, during and after the event.

The cause was suspected to be a failure of one of the circuit cards for train "A" of Solid State Protection System (SSPS) (EF) JE! SG level. The associated cards were replaced and the removed cards were tested "on the bench". One universal logic card showed signs of degrading voltage with time.

Operability tests and functional tests were performed to verify operability of the replaced circuit cards.

This event is reportable per 10CFR50.73(a)(2)(iv), any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature including the Reactor Protection System.

(9969R/WPF/020294-2)

END OF ABSTRACT

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#### A. PLANT CONDITIONS PRIOR TO EVENT:

Event Date/Time 11-23-93 / 0046

Unit 2 MODE 1 - POWER OPERATION Rx Power 100%  
RCS AB! Temperature/Pressure NOP/NOT

#### B. DESCRIPTION OF EVENT:

On November 23, 1993, with Unit 2 at 100% power Normal Operating Pressure and Temperature, the Instrument Maintenance (IM) Department was performing surveillance 2BIS 3.1.1-024, which functionally tests loop LB559C (2D SG level) (FW) JB!. The loop was put in test as required and the appropriate alarms came up. Anticipated Transient without Scram Mitigation System (AMS) was also put in test per the surveillance and the associated alarms came in. Six minutes into the loop functional check, the 2A Auxiliary Feedwater (AF) BA! pump auto started and all Steam Generator (SG) blowdown isolation valves closed concurrently. The Unit Operator placed the 2A AF pump in the pull-to-lock position and entered Limiting Condition of Operations Action Response (LCOAR) 7.1.2-1a. This prevented the 2A AF Pump from starting when the reactor subsequently tripped. Approximately 3.5 minutes later a reactor trip occurred with trip breaker A opening. The Rx Trip Breaker Open position caused a turbine trip. A turbine trip above P-8 (30% power) generates a Rx Trip signal which then opened the B Reactor Trip Breaker. All equipment

functioned as designed. All related plant parameters were normal prior to the event. All Operations and Instrument Maintenance personnel actions were appropriate prior, during and after the event.

This event is reportable per 10CFR50.73(a)(2)(iv), any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature including the Reactor Protection System.

#### C. CAUSE OF EVENT:

When Unit 2 was stabilized in mode 3 (hot standby), efforts were made to determine the cause. The three unexpected actuations were 2A AF pump auto start, SG blowdown isolation, and reactor trip with trip breaker A after 3.5 minutes. The actuations received during this event suggested three possible causes: AMS malfunction, SSPS (EF) JE! malfunction or IM Department functional error.

AMS was reviewed to determine if it had malfunctioned. The results of this review were that AMS had not caused the event because both trains of AF would have started, and a turbine trip would have occurred before the reactor trip. Also, there is no relation between AMS and SG blowdown isolation. The only time that the 2A AF pump and SG blowdown isolation occurs concurrently is in the SG level circuitry of SSPS (See Electrical Print 6E-2-4030EF34).

At the time of the event, one of the four channels of 2D SG level was in test per the IM Department functional surveillance. This logic card requires a two of four coincidence to cause an actuation. If the two of four logic had been present, the other channel's 2D SG level alarms would have been received. Lack of associated alarms indicates that the IM functional did not cause the event.

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#### C. CAUSE OF EVENT (cont'd):

The cards in the SSPS actuation circuit were all considered suspect. Operations Department performed a logic test (2BOS 3.1.1-20) on the circuits in question and found no problems. Circuit cards A517, A316 and A218 were replaced, under Nuclear Work Request B02937, and reactor trip card A515 was checked. Through this circuitry, the 2A AF pump start, SG blowdown isolation and reactor trip should have occurred simultaneously. It is believed that an intermittent

breakdown of a circuit board component caused the AF and SG blowdown actuations. These actuations occurred at approximately 12 VDC, then the card reset itself. After 3.5 minutes, the logic card output voltage dropped below 6.8 VDC which generated the reactor trip. After replacing the suspect cards, they were tested to determine the component that failed. All three cards were found to be functioning correctly, however, the failure is potentially intermittent because the initiating condition had cleared after the event and no failure was found after testing the removed cards.

Operations performed their logic test after the card replacement and IMD reperformed their functional on loop LB559C twice to ensure operation of switches and circuitry. All testing was successful with no abnormalities in mode 3. SSPS was declared operable based on these tests. The investigation above was performed by three teams independently and all reached the same conclusion of an intermittent failure of one of the cards in the "A" train of SSPS. Additional testing of the cards has continued by the IMD to determine the failure mode. One of the universal logic cards has exhibited a degrading voltage condition.

Further testing of the removed cards (A218, A316, and A517) has been completed with no definitive results (individual card component failure). Strip chart recordings of various tests performed lend credence to the suspicion of an intermittent card failure. Specifically input 13, on pin 19 A218, has a film breakdown resistor (R3, 30.1 Kohm, Westinghouse schematic drawing 1046F57 - Universal board) to maintain approximately 15 VDC on pin 19. This voltage has been approximately 7 VDC during the testing. On a couple of different occasions, the voltage has risen to 15 VDC, but quickly returned to the 7 VDC range. With the input voltage starting at this lower value, a small oscillation on the input line could cause it to appear that a low signal was present generating a one of four trip signal. As another input line was in test for the Instrument Maintenance Department functional, the two of four trip logic was satisfied. The fluctuation was so rapid that the one of four logic on card A316 started to change state due to the input from A218. However, the output signal from A218 returned to a nontripped state causing the output voltage of A316 to return to approximately 15 VDC after the voltage dropped below the threshold point to start the auxiliary feedwater pump (approximately 12.5 VDC), but before the reactor trip voltage level of approximately 6.8 VDC. Then 3.5 minutes later, the voltage drop was of sufficient duration that the reactor tripped. The auxiliary feedwater pump did not start as the control switch on the Main Control Board had been placed in the pull-to-lock position following the first initiation.

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#### D. SAFETY ANALYSIS:

There were no safety consequences as a result of this event. All Engineered Safeguards Features Systems (ESF) responded as expected and the unit was safely shut down.

#### E. CORRECTIVE ACTIONS:

The immediate corrective action was to replace the suspect circuit cards.

The A218 card was sent to Westinghouse for root cause failure analysis. The failed component was determined to be CR5, a 1N980B 62 volt zener diode. R3 would have displayed the same failure mechanism and they are in the same circuit. For a complete report on the root cause analysis, see Westinghouse letter RCS-PSD(94)-348 (attached). The A218 universal logic card has been returned to Byron Station and scrapped.

#### F. PREVIOUS OCCURRENCES:

There has been one previous occurrence of a reactor trip caused by a SSPS card failure.

LER 455-91-004 Train B Feedwater Isolation signal due to Logic Card Failure.

The card failure in this event was similar in nature but the failure caused a spurious Train B Feedwater Isolation.

#### G. COMPONENT FAILURE DATA:

MANUFACTURER NOMENCLATURE MODEL NUMBER MFG PART NUMBER

Westinghouse Circuit Board, 6056D21GO1  
Universal SS  
Protection

(9969R/WPF/020294-5)

ATTACHMENT TO 9502150280 PAGE 1 OF 2

Commonwealth Edison Company  
Byron Generating Station  
4450 North German Church Road  
Byron, IL 61010-9794  
Tel 815-234-5441  
February 07, 1994

ComEd

LTR: BYRON 95-0057  
FILE: 3.03.0800 (1.10.0101)

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Dear Sir:

The Enclosed Supplemental Licensee Event Report from Byron  
Generating Station is being transmitted to you in accordance with the  
requirements of 10CFR50.73(a)(2)(iv).

This report is number 93-008; Docket No. 50-455.

Sincerely,

G.K. Schwartz  
Station Manager  
Byron Nuclear Power Station

GKS/DSK/ng

Enclosure: Licensee Event Report No. 93-008

cc: J. Martin, NRC Region III Administrator  
NRC Senior Resident Inspector  
INPO Record Center  
CECo Distribution List

(9969R/WPF/020294-6)

A UNICOM COMPANY

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SIGNATURE PAGE FOR LICENSE EVENT REPORT

LER Number  
455:93-008-S1

Title of Event: Reactor Trip/Turbine Trip due to Solid State  
Protection System Universal Logic Card Intermittent  
Failure Supplemental Report

Occurred: 11-23-93 / 0040  
Date Time

OSR DISCIPLINES REQUIRED: /  
GES DATE

Acceptance by Station Review:

//  
OE Date SES Date

//  
RAS Date OTHER Date

Approved by: /  
Station Manager Date

(9969R/WPF/020294-1)

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